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ABSTRACT

Policymakers and educators agree that technology education is crucial to the development of a technologically literate society that can compete successfully in the world of the 21st century. Technology education is the study of: the application of adaptive systems, including tools, capital, materials, processes, energy, information, and people; the uses of knowledge and technical means to solve practical problems; and the effects of technical solutions in individuals, society, and culture. As a leader in the field of technical education, New Jersey has produced an outstanding curriculum model. Although significant educational gains have been made, the state must continue to strengthen and encourage technical education programs in its schools. A 1989-90 study showed that New Jersey elementary teachers are interested in including more technology education in their classroom instruction, feel that technology education is important, and would like more guidance on the subject. Middle school teachers said that hands-on technology courses encourage students' abilities to think and solve problems creatively. Scores on 1990 technology achievement tests indicate there has been a significant increase in the understanding of technology among middle school students. Students, parents, and administrators see technology education as a program that allows students to integrate many curriculum areas in a creative and thought-provoking manner. (19 references) (Author/CML)

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TECHNOLOGY EDUCATION IN NEW JERSEY 1990

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CE 055 323

STATE OF NEW JERSEY
OFFICE OF THE GOVERNOR
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JIM FLORIO
GOVERNOR

Dear Friends:

This is a period of tremendous change in public education in New Jersey. School reform has become part of both the state and the national agenda. For the first time we have set national goals for education. The world has changed and we must change what we provide for, and what we ask of, our young people. We must raise our expectations and our standards. To keep the United States competitive in the world, the quality of our public schools must be improved and our students must be prepared to meet the challenges of the future.

Strengthening technology education and encouraging new applications of technology must be part of New Jersey's agenda for school reform. Technology means more than exposure to shop classes. It means more than just computer literacy. Technology is a broader term. It is the application of our scientific knowledge to create new tools and new methods to achieve our goals. Technology brings new products to our homes from all over the world, saves lives in hospitals, helps scientists discover cures to once-fatal diseases, and creates the tools to save our environment.

Our youth must be prepared to use the emerging technologies in their fields of study. They must have hands-on experience with advanced technologies. New computer applications, laser disks, and distance learning over satellites will help us provide these opportunities when schools cannot afford to provide the technologies on site. Students must grasp the essential principles of the emerging technologies so they can contribute to further development and creative applications.

We cannot expect our young people to master all of the complexities of modern technology. However, they must understand the connections between these technologies and the values and communities they hold, for they will be asked to make decisions that may affect the very nature of life itself. They must know what questions to ask and what precautions to take as new advances are made in technology. This must be the purpose of technology education.

Sincerely,

Jim Florio

Jim Florio
Governor

Purpose of the Technology Education Report

The purpose of this report is to familiarize the citizens of New Jersey with the Technology Education movement, to increase awareness of New Jersey's contribution to this movement, to assess the initiatives which have taken place, and to report on current research on the elementary and middle-level Technology Education programs in New Jersey.

Throughout the United States, politicians and educators agree that Technology Education is crucial to the development of a technologically literate society which can compete successfully in the world of the Twenty-first Century.

Technology Education is the study of

—applications of adaptive systems (tools, capital, materials, processes, energy, information, and people)

—uses of knowledge and technical means to solve practical problems

—impacts of technical solutions on individuals, society, and culture.

Executive Summary:

• As a leader in the field of Technology Education, New Jersey has produced an outstanding curriculum model. While significant educational gains have been made, the state must continue to strengthen and encourage Technology Education programs in its schools.

• A 1989/90 study showed that New Jersey's elementary teachers are interested in including more Technology Education in their classroom instruction. They also feel that Technology Education is important to the education of elementary children. The teachers indicated that they would like more guidance in the area of Technology Education.

• At the middle-school level, teachers stated that hands-on technology courses encourage students' abilities to think and solve problems creatively. Scores on 1990 Technology Achievement Tests indicate that there has been a significant increase in student understanding of technology. As programs are strengthened at the elementary level, Technology Educators anticipate further increases in achievement.

• Students, parents, and administrators have been found to be enthusiastic about their experiences in Technology Education. They see Technology Education as a program which allows the student to integrate many curriculum areas in a creative and thought provoking manner.

• Education must prepare students to innovate, develop, and apply new technologies so that the United States can remain internationally competitive.

National Focus on Technology

Ninety percent of the knowledge and technology which will be available after the year 2000 has not yet been created. Students in the Twenty-first Century will face a time when knowledge is doubled every two and one-half years (Barnes, 1989). Educators face the challenge of not being able to teach students all the information they will need to know during their life-times. Education, at all levels, is the most important factor in preparing young people for the changes they will face in the future.

Governor Thomas Kean, quoting Benjamin Franklin, said "No nation is ruined by trade, but we will be [ruined] if we do not teach our children to think" (T is for technology, 1988). President George Bush expressed the same concern when he said our goal is "to make the United States more competitive around the world. . . . We must not lose our prominence in science and technology" (President pursues science, 1990, p.8). In light of rapid change, Technology Education has become a critical part of the education of all school children. To better prepare students for a complex world, students need to develop skill in the use of the problem-solving process.

Anton Campanella, President of Bell Atlantic, in his 1987 Technology Conference Address, said "It is clear I'm going to be counting on our schools to produce a work force I can hire that has the ability to learn—and relearn the latest about—technology. I need people who won't be illiterate the minute a change in technology occurs. These people will be comfortable with technology, comfortable with change, and comfortable with constantly learning new things."

Focus on Technology Education in New Jersey

New Jersey is currently a leader in high-technology industries. However, in a highly competitive business environment, a technologically literate population is vital to attracting and retaining these industries. New Jersey has taken the following actions to meet this challenge:

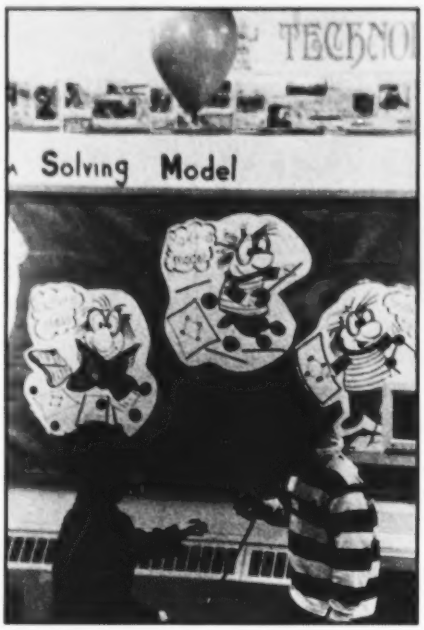
In 1983 the New Jersey Commission on Science and Technology developed a plan for economic growth and job development in New Jersey. The commission set forth a Strategy for Action to make New Jersey a center for technology in the United States. The Governor's Commission recommended the educational community must "strengthen public schools' curricula to better prepare students for the challenges of our rapidly changing technological society" (Report of the Governor's Commission on Science and Technology, 1983).

In 1984 the Commission on Technology Education (COTE) for the state of New Jersey was organized to develop, promote, and adopt a Technology Education Curriculum Model within the public schools. Approximately 100 schools have now incorporated some concepts of the New Jersey Technology Education Curriculum Model (Implementation, 1989).

N.J Technology Education Curriculum Model

The New Jersey Technology Education Curriculum Model consists of four concept phases:

1. Developing an Awareness of Technology (elementary school): A thematic approach is taken which organizes the study of school subjects around a common theme which provides the focus for familiarizing students with the impact of technology on their lives and acquainting them with technological design and problem solving.



2. Exploring Technology (middle school): As children begin to specialize in courses, they explore the importance of technology in shaping their future. The course, Design and Problem Solving, emphasizes the design/ problem-solving processes and the systems approach to understanding technology.

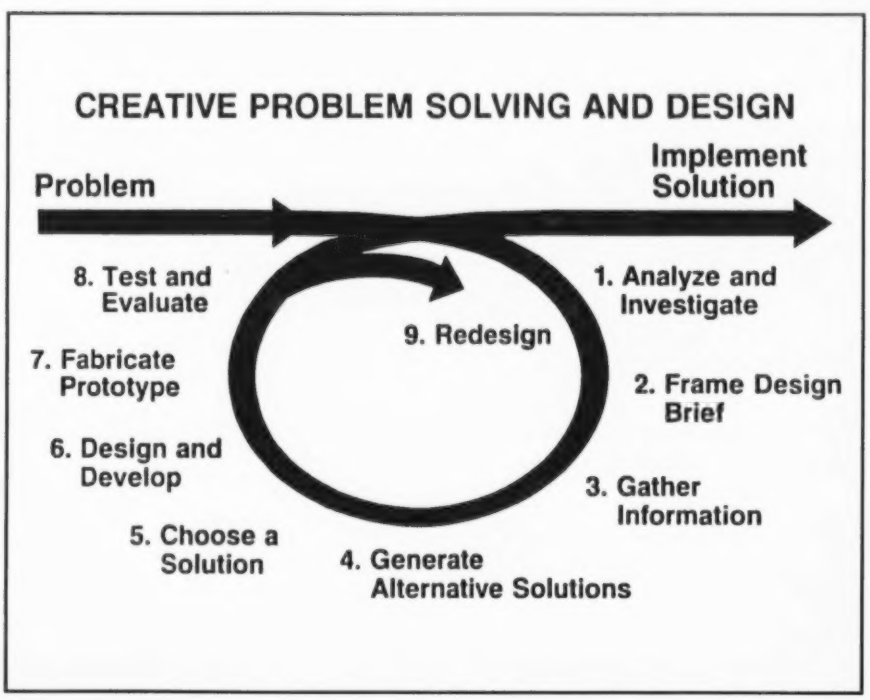
3. Studying Technology (high school): Students take the general course, Introduction to Technology, and follow their individual interests in specific technological areas.

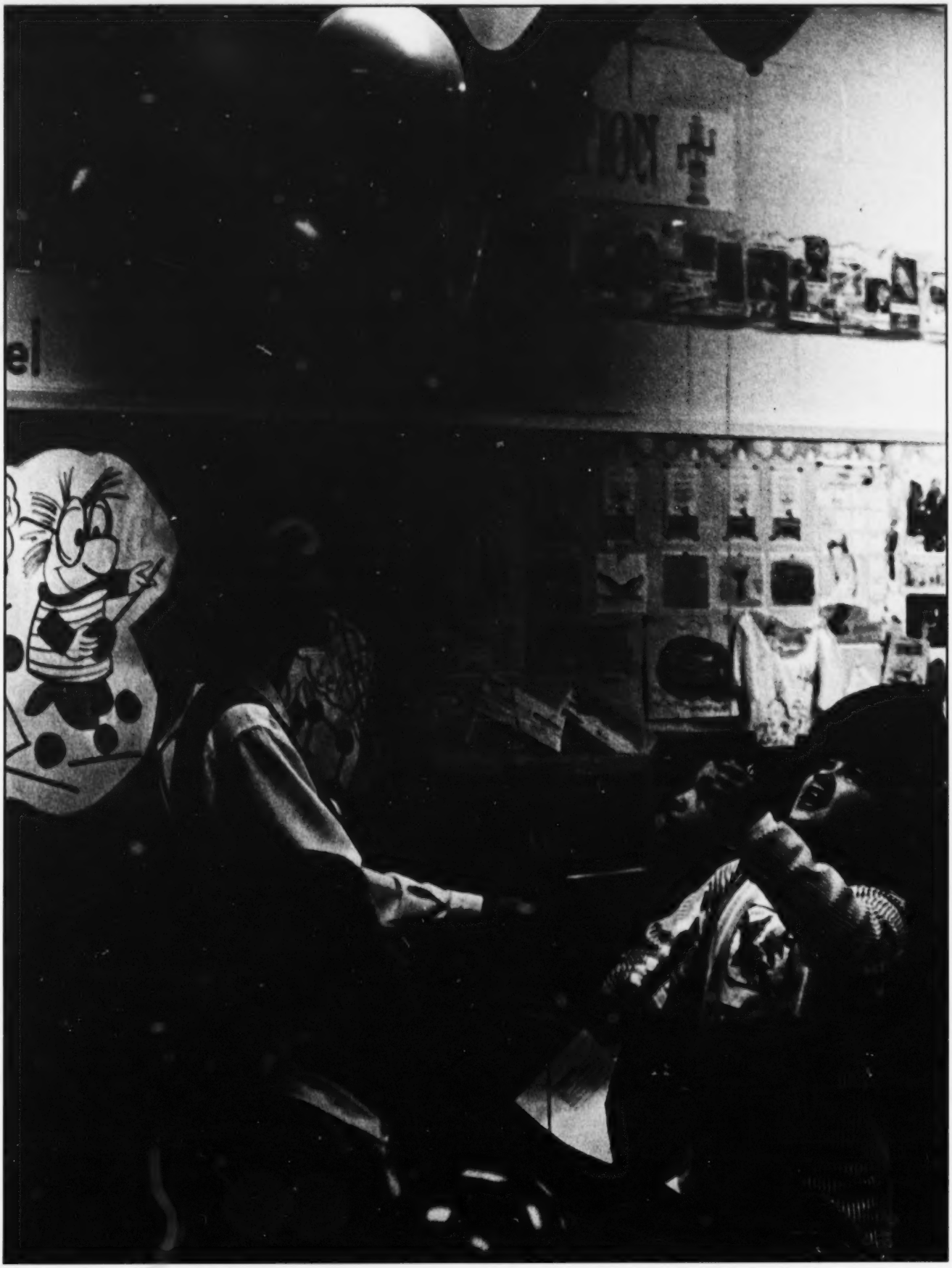
Emphasis at this level is on direct involvement with technology and analyzing the consequences of technology on the individual and society.

4. Applying Technology (high school): Students have the opportunity to gain in-depth experiences and expertise according to their career paths.

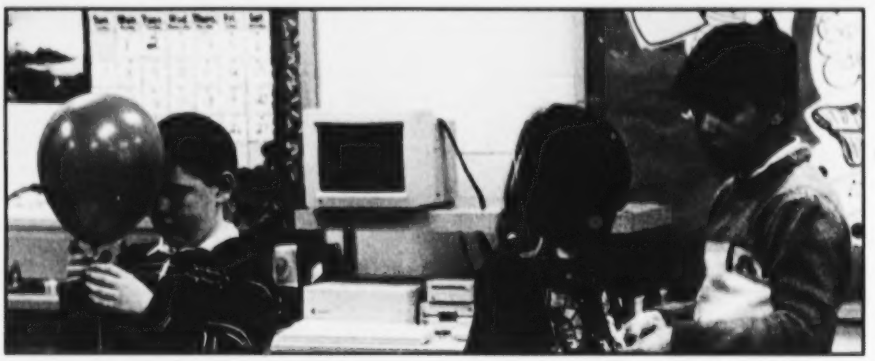
Technological Problem Solving and Design

Central to implementing Technology Education is understanding the technological problem-solving and design process. The design loop provides an educational model which emphasizes the continuing and holistic nature of the design process. It provides opportunities for students to develop alternative solutions to problems within the process of developing a final solution. "A primary goal is for students to learn to recognize that for every problem there are a variety of alternative solutions which may be successfully implemented" (Cuetara, 1988, B 1).





Research: Technology At The Elementary School Level



In 1989/90 a study was conducted to examine the status of Technology Education in New Jersey elementary schools (Reilly, 1990). A panel of elementary educators developed a questionnaire based on the kinds of technology activities which might appropriately be included in the classroom activities of elementary school children. A survey was conducted to determine which of the identified activities school districts included in their present programs, at what grade level these activities occurred, and how often the activity was performed. Questionnaires were distributed to a random sample of 150 school districts; 52 school districts (99 teachers) responded to the questionnaire. All school districts indicated that they include some technological activity in their program. The findings of the study were as follows:

* 80% of the teachers said they would like to include more technological activities in their classroom instruction.

* 90% stated that technology was important to a child's education.

* 92% of the teachers felt Technology Education should be infused into other subject areas.

* 5% of the teachers indicated that their district has a district-wide guide for Technology Education. Technology Education was included at the discretion of the individual teacher in 14 % of the districts.

* Significantly more instruction in technology takes place at the 4-6 grade level than at the K-3 grade level. Although all districts surveyed included some Technology Education in their programs, the average level of inclusion was less than once per semester for all activities with the exception of those involving computers and communication equipment: these activities were included slightly more than once per semester.

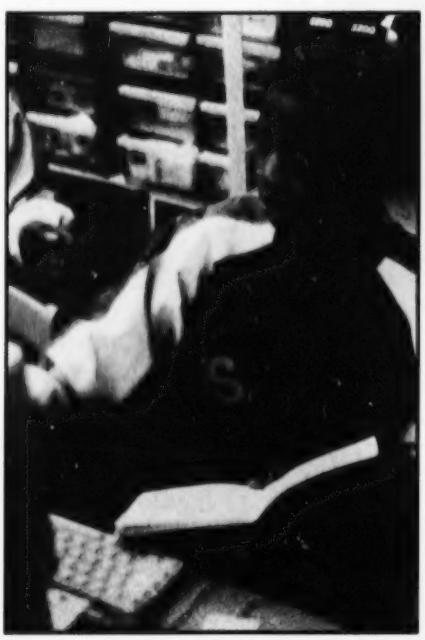
* The most frequently included student activities for both grade levels were working with computers, using communication equipment, applying subject-matter content in studying technological problems, and recognizing the positive and negative aspects of technology. These types of activities tend to occur almost once per month.

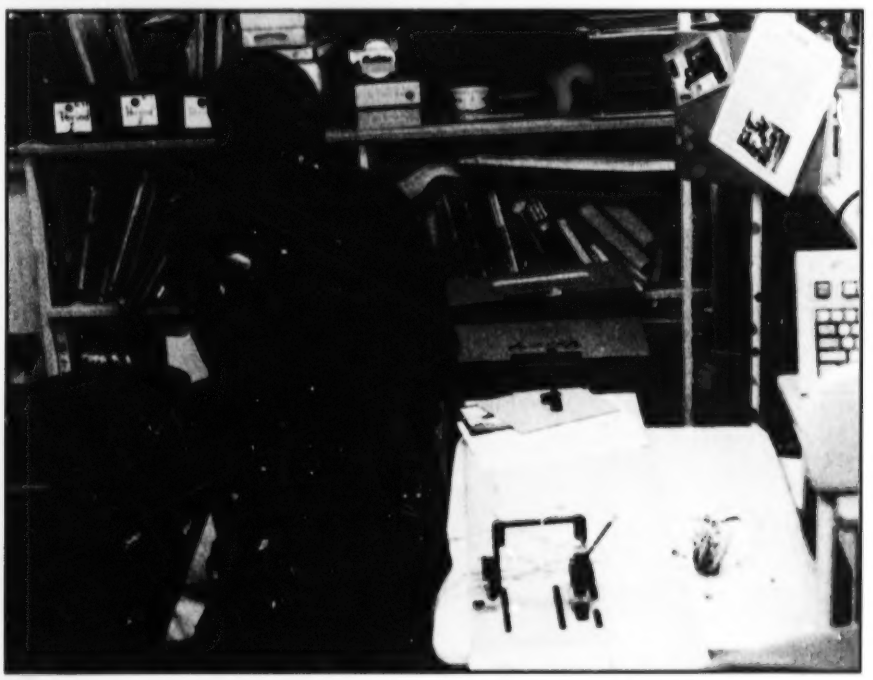
* The activities least likely to be included in the program are those concerned with technological problem solving, use of the systems model, and the evaluation of solutions. On the average, these types of experiences occur less than once per year.

Research: Student Achievement in Technology Education

Several research studies have been concerned with student achievement in the middle-school (grades 7-9) technology courses. In 1988/89 a preliminary study was conducted with 111 middle school students enrolled in technology classes in four school districts (Wallace, 1989). Data was collected before and after students took the introductory level technology course. After completing this course, students exhibited a significant increase in their understanding of the consequences of technology, the differences between science and technology, and the use of the design loop.

A 1989/90 study examined student's achievement of technology proficiencies in grades 6-9 (Reilly, 1990). A Technology Achievement Test was developed by a panel of technology teachers. Students (223) in ten schools offering technology courses, as defined by the New Jersey curriculum model, were tested. As a control group ten schools (174 students) not offering Technology Education courses were also tested.





The results were as follows:

* Students had a highly significant increase in their understanding of technology as a result of the course.

* Female students were found to be slightly more knowledgeable than male students. Although female students did well in technology classes, the percentage of female students enrolled decreased with each successive grade level.

* While technology students were significantly more knowledgeable about all areas of technology, the area in which technology students showed the greatest difference from non-technology students was in identifying and applying the technological design and problem-solving model.

* A difficult area for all students was the test segment concerned with control technology: application of hydraulic, pneumatic, electrical, and mechanical devices. However, technology students were significantly more knowledgeable than non-technology students on this portion of the test.

Research: Attitude Toward Technology Education

Two recent research studies explored attitude toward Technology Education. Researchers were concerned with identifying the kinds of experiences which are related to students' interest in technology and determining what parents, teachers, and administrators perceive about Technology Education.

In 1989 a middle-school pilot study was conducted among parents of technology students, teachers, and administrators in four school districts (Phelps, 1989). The survey indicated that parents had a positive attitude toward Technology Education. They felt that their childrens' education had been enhanced, that the children were better able to use the problem-solving process, and that they had been given opportunities which would help them in identifying a career. Parents expressed concern that the use of hand and power tools and the making of take-home projects, which are considered important aspects of the traditional industrial arts program, could be lost in Technology Education classes. However, Technology Education does provide these types of experiences for students as they engage in the construction activities required to solve technological problems.

Teachers and administrators found many advantages in Technology Education. They saw technology courses as an interdisciplinary core which helps the students keep pace with a rapidly changing world, understand the resources and processes which shape society, and develop creativity and critical-thinking skills. They stated that, in their experience, the cost and maintenance of technology laboratories are comparable to those of traditional industrial-arts facilities.

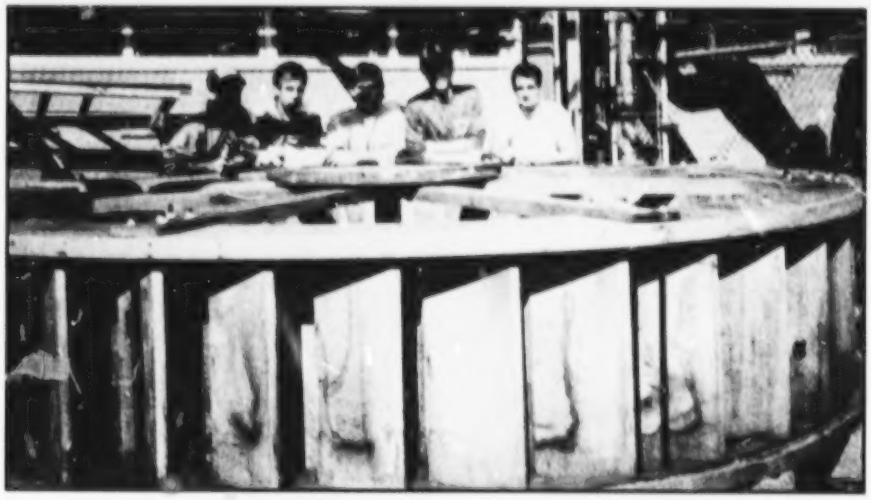
Attitude toward technology appears to be highly related to familiarity. The Pupil's Attitude Toward Technology Study indicated that student interest in technology is highly related to their personal experiences (Bame, 1989). Student interest increased with the number of courses taken. The most positive attitude toward technology was exhibited by those students who had parents involved in technological careers, had technological toys, workshops, and/or personal computers at home. When students, parents, teachers, and administrators see Technology Education in action, they are enthusiastic.

New directions: An Interdisciplinary Curriculum

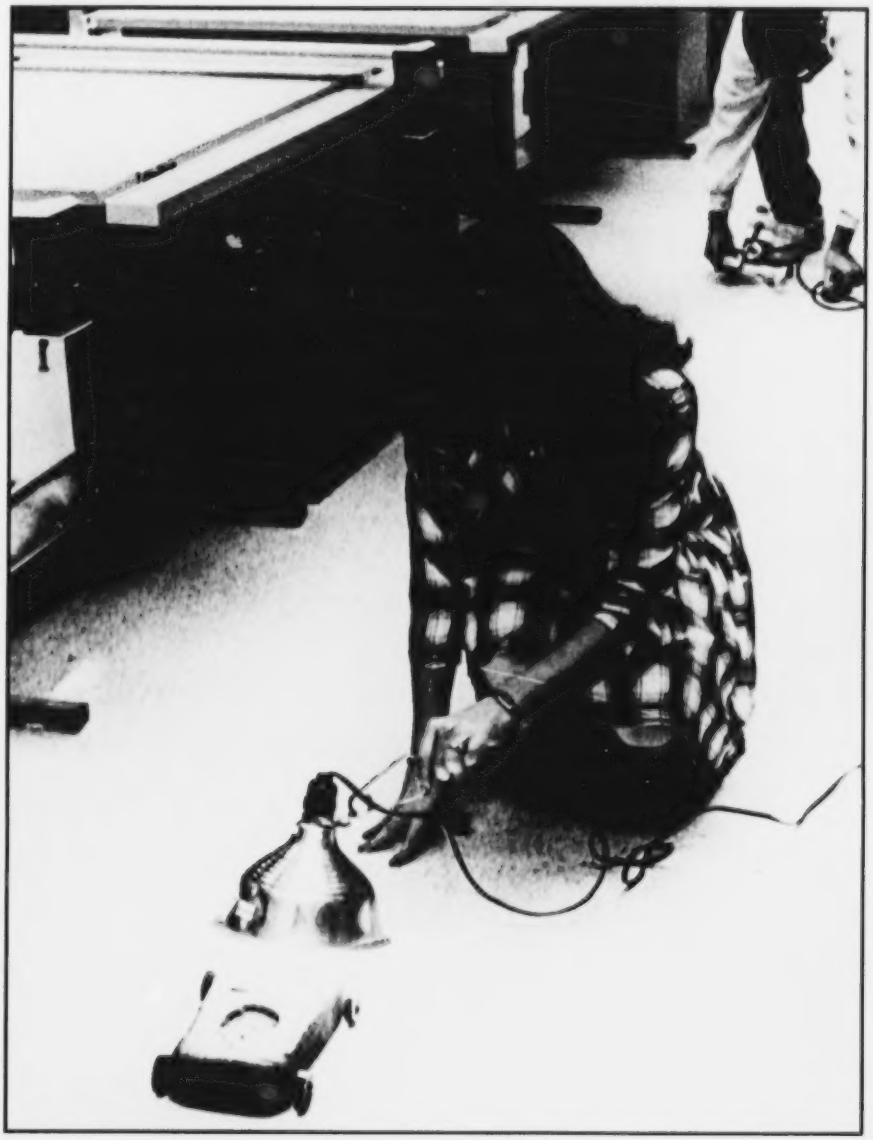
Technology Education is not only a subject area, it is a way of learning which integrates many subject areas and provides opportunities for critical thinking. By integrating all areas of the curriculum, Technology Education encourages the student to think critically, respond with flexibility and confidence, and initiate technological problem solving and investigation as a means of learning (Implementation, 1989). Students learn from each other and from hands-on experiences as they go through the technological problem-solving process. Teachers have noted that Technology Education tends to serve as a unifier of the school curriculum (Leadership, 1990).

Many educators and business leaders believe that the strict departmentalization of subjects must be discontinued. (McHaney, 1988). According to Dr. Gerald Lysik, Superintendent of Schools, Lakeland Regional High School District, the job of educators is to "take separate and discrete curricular strands that have been artificially separated and weave them together" (T. is for technology, 1988).

The Technology Education students at Lakeland Regional High School had such an experience when they were asked to work on the restoration of a water wheel by the local historical society. The water wheel was removed and disassembled by the students with help from the New Jersey Park Service. Two years of work were involved in the fabrication of the replacement wheel. Courses such as woodworking, architectural drawing, drafting and design, energy and transportation, and historical research were needed to complete this problem-solving project. According to the technology teachers, the experience was a unique educational opportunity because it involved students in a community-service project and at the same time enabled them to rebuild a part of local history (LoCascio, 1990).



Future Need for Technology Education



The United States led the world into the Age of Technology, but it is failing to provide our children with the intellectual tools needed for the Twenty-first Century (National Science Board, 1983). Today's society is demanding more sophisticated intellectual and interpersonal skills from employees. Besides improving basic mathematics and reading skills, men and women must develop creative-thinking and problem-solving skills to be able to make decisions and contribute to the solutions of tomorrow's challenges in business and industry (Carnevale, Gainer, & Meltzer, 1988).

According to James Ferland, Chairman of the Board of P.S.E.& G. Co., "The future of New Jersey and the nation depends on the ability of people to innovate, develop, and apply new technologies. To assure that this innovation process continues, it is of paramount importance that the education and training offered to our young people also move forward into the broad based Technology Education programs of the future" (Implementation, 1989).

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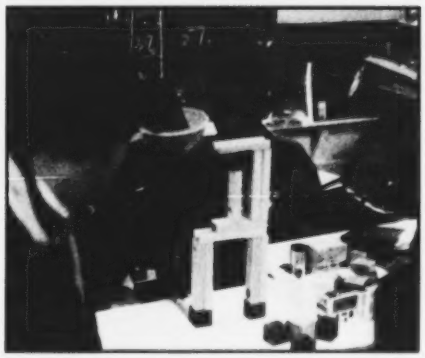

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